Book Review

WEISS, E. (Editor). 1971. Arthropod cell cultures and their application to the study of viruses. Current topics in Microbiology and Immunology. Vol. 55. Springer-Verlag, Berlin, Heidelberg, New York. xx + 288 pp., 151 figs., author and subject indices. Cloth. $22.60 (U. S.).

Although this book presents the proceedings of a symposium, it is much more than the collection of papers on rather unrelated topics that usually emanates from such conferences. Its contents are organized into 11 chapters with the following titles: 1. The culture of cells from insects and ticks; 2. Analysis of cells from established insect cell lines; 3. Physiology of cultivated arthropod cells; 4. Arthropod tissue culture in the study of arboviruses and Rickettsiae: A review; 5. Propagation of arboviruses in Singh's *Aedes* cell lines; 6. Growth of arboviruses in arthropod cell cultures: comparative studies; 7. Growth of viruses in arthropod cell cultures: applications; 8. Homoptera cell culture and its application to the study of plant pathogens; 9. Lepidoptera cell culture and its application to the study of plant viruses and animal parasites; 10. *Drosophila* cell culture and its application for the study of genetics and virology; and 11. New opportunities in biological research offered by arthropod cell cultures.

Each chapter contains several papers on topics related to the chapter title. References are gathered together at the end of the book. The approach of different authors varies: some contributions are short research reports, while others are full accounts with summaries of previous work and discussion of implications for other fields and for the future.

In Chapter 2, J. L. Vaughn emphasizes the difficulties inherent in research in invertebrate tissue culture. Accidental contamination of cell lines with microorganisms or with cells from other lines will probably become a problem as more lines are introduced and as the use of these proliferates. Since cells in culture look similar regardless of their source, contamination of this kind cannot be recognized by differences in cell morphology. A. E. Greene and J. Charney received a cell culture supposedly from *Aedes aegypti* in their lab in 1967. Using agar gel immunodiffusion and isoenzyme analysis they showed that this culture had been contaminated and replaced by cells of a moth, *Antherea eucalypti.* They indicate also how these techniques can be used in identifying cultures of mammalian, piscine and avian origin and in separating these from cells of arthropod origin.

Since the organs and tissues of animals are comprised of cells organized and specialized in particular directions and because the form of these structures is determined by the genetic makeup of the cells interacting with the environment during and after embryonic development, T.D.C. Grace suggests that a good way to study these phenomena is in tissue culture where the investigator has some control over the cells' surroundings. R. L. Seecof and R. L. Teplitz monitored the development of individual cells from dissociated embryos of *Drosophila*. Some of these divided unequally and produced long extensions in culture. Events similar to these occur in the development of the central nervous system from neuroblasts during normal embryogenesis. When the neuro endocrine organs of the cockroach, *Leucophaea maderae* were explanted in culture, they continued to function *in vitro* for some time (E. P. Marks).

J. H. Conover and his colleagues succeeded in producing bi-nucleate, somatic cell hybrids between mosquito (*Aedes aegypti*) and human (He La) cell lines. When control He La cultures were innoculated with polio virus, they died within three days whereas mosquito-human hybrids persisted until day 10. Mosquito (*Aedes aegypti*) cell cultures were little affected when treated with organo-phosphate, carbamate, chlorinated hydrocarbon, arsenical, nicotine and pyrethrin insecticides, but similar amounts of these chemicals applied to larvae killed them (T.D.C. Grace and J. Mitsuhashi).

There are two reviews in the book: one by C. E. Yunker on the culture of arboviruses and Rickettsiae in cultured cells and the other by H. Hirumi on the use of homopteran cell cultures in the study of plant pathogens. Yunker points out that two thirds of all published work in the area of his review was done in 1968 and 1969. From this work he concludes, among other things, that primary cultures of arthropod tissues will support growth of viruses that that particular donor arthropod or a relative can transmit. Arboviruses may propagate to a higher degree in cultures of vector tissues than in the cells of the intact arthropod. Since primary tick cultures and established insect cell lines are very sensitive to many arboviruses and Rickettsiae, they may be used to detect these pathogens at lower concentrations than do techniques (animal, egg, or vertebrate culture) now used.

Since there is little knowledge of how plant virus particles penetrate and multiply in the cells of their vector species, Hirumi suggests that the successful culture of these microorganisms in vector cell cultures is a promising avenue of research. Both virus-vector and mycoplasma-vector interactions have been studied in cultured embryonic cells of leafhoppers, aphids and planthoppers.

Although most articles in the book deal with virus-cell culture interactions, one by T. J. Kurtti and M. A. Brooks summarizes their successful culture of *Glugea disstriae*, a microsporidian protozoan, in cell cultures of *Malacosoma disstria* and *M. americanum*. Since this microorganism is a naturally-occurring parasite of these insects, eventually we may be able to use tissue-culture techniques in the mass-production of this and other protozoan parasites for biological control of pest species.

C. Barigozzi summarizes the advantages of using *Drosophila* cell culture for genetical studies. Molecular biologists are beginning to switch their activities from procaryote to eucaryote organisms because of their increasing interest in the factors controlling development in higher organisms. *Drosophila* cell lines have advantages over vertebrate ones for biochemical studies of this kind because the genetics of this genus is so well understood. Particularly useful is the occurrence of somatic pairing and the ability to induce crossing-over in these cells by X-ray irradiation as has been shown by H. A. Schneiderman and his students at Irvine, California. Such techniques could be put to good advantage in *Drosophila* cell lines since an accurate genetic analysis is aided by crossing-over.

The future of tissue culture is speculated upon by B. W. Schlesinger and W. Trager in the final chapter. Schlesinger suggests that culture work with viruses may eventually shed some light on the evolutionary origin and relationships between different, arthropod-transmitted plant and animal viruses. These viruses, as he emphasizes, are the only ones known to bridge the evolutionary gaps between kingdoms (animals and plants) and phyla (arthropods and vertebrates). The ability to switch such viruses back and forth between vertebrate and arthropod cells under controlled conditions should help us to understand both of these subjects. He speculates on the evolutionary origin of viruses and asks questions which may be answered with culture techniques.

Since Trager was the first (1935) to culture viruses (nuclear polyhedrosis) in invertebrate (*Bombyx mori*) tissue culture, it is fitting that he should have the final say in this book. He predicts that major breakthroughs in the understanding of parasitic protozoan life cycles (e.g. malaria, sleeping sickness), insect mycetomes and their function, and insect development will follow from increased work in insect tissue culture. Why, he asks, do the cells of larval Cyclorrhapha stop dividing in the egg and subsequently develop through an increase in cell size and chromosomal polyteny? This does not occur when embryonic cells of these insects are cultured; when explanted they continue to increase in number by mitosis. He completes his discussion with reference to the work of Hadorn and his students on determination and transdetermination in *Drosophila*. The whole theory of structural homology, so

important in comparative morphological, palaeontological, evolutionary, and systematic studies, can be thrown into question, if, as has been shown experimentally, cells determined to form one structure, can be "transdetermined" in nature to form almost any other in the body.

This book should have wide appeal. Plant pathologists, microbiologists, parasitologists, medical entomologists, and developmental biologists will profit from a careful reading of pertinent parts of it. The book is well produced and is amazingly free of typographical errors (I found three) considering that its English text was printed in Germany. With a few exceptions, the photomicrographs are excellent. However the price ($22.60) indicates why it is that violation of copyright is an increasing problem.

Bruce S. Heming
Department of Entomology
University of Alberta
Edmonton 7, Alberta

ANNOUNCEMENT

An English translation of Rohdendorf's Historical Development of the Diptera edited by Harold Oldroyd and Brian Hocking will be published by the University of Alberta Press in the Fall of 1972. A further announcement concerning price and details will follow.